Fraunhofer
ILT

FRAUNHOFER INSTITUTE FOR LASER TECHNOLOGY ILT

NONLINEAR OPTICS AND TUNABLE LASERS

DQS certified by
DIN EN ISO 9001:2015
Reg.-No. 069572 QM15

Fraunhofer Institute
for Laser Technology ILT

Director
Prof. Constantin Häfner

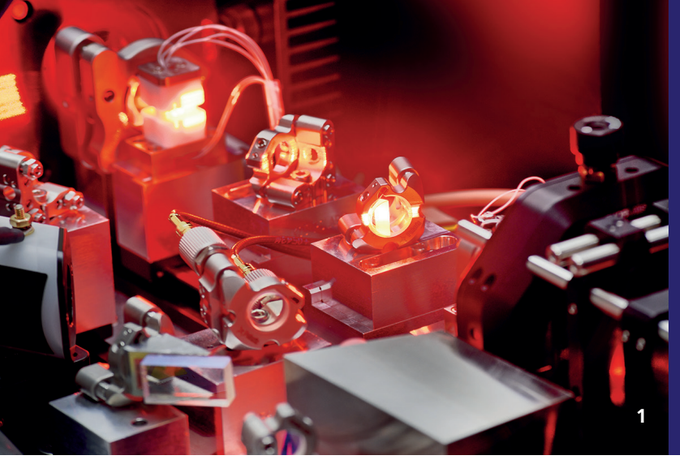
Steinbachstraße 15
52074 Aachen, Germany
Telephone +49 241 8906-0
Fax +49 241 8906-121

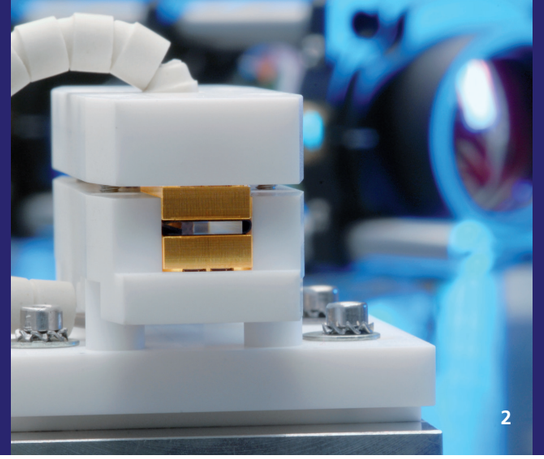
info@ilt.fraunhofer.de
www.ilt.fraunhofer.de

Fraunhofer Institute for Laser Technology ILT

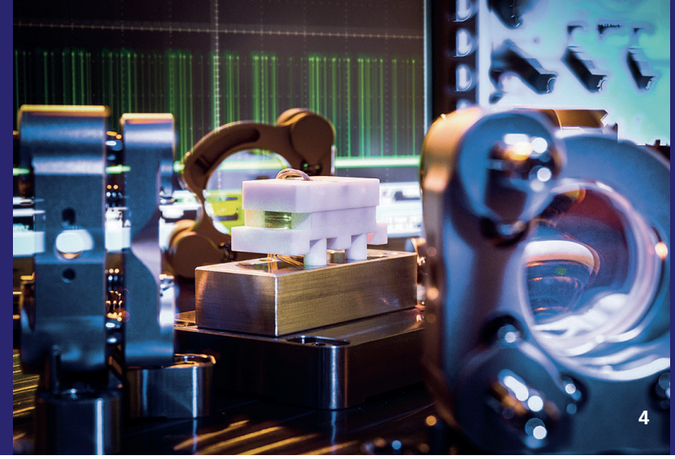
The Fraunhofer Institute for Laser Technology ILT is one of the most important development and contract research institutes in laser development and application worldwide. Its activities encompass a wide range of areas such as developing new laser beam sources and components, laser-based metrology, testing technology and industrial laser processes. This includes laser cutting, ablation, drilling, welding and soldering as well as surface treatment, micro processing and additive manufacturing. Furthermore, Fraunhofer ILT develops photonic components and beam sources for quantum technology.

Overall, Fraunhofer ILT is active in the fields of laser plant technology, digitalization, process monitoring and control, simulation and modeling, AI in laser technology and in the entire system technology. We offer feasibility studies, process qualification and laser integration in customized manufacturing lines. The institute focuses on research and development for industrial and societal challenges in the areas of health, safety, communication, production, mobility, energy and environment. Fraunhofer ILT is integrated into the Fraunhofer-Gesellschaft.


1


2


3


4

NONLINEAR OPTICS AND TUNABLE LASERS

Opening up new wavelength ranges – specific to an application – multiplies the potential uses of modern laser-beam sources in industry and research. The Fraunhofer Institute for Laser Technology ILT develops systems, based on tunable lasers and frequency converters, with tailor-made wavelengths for different power classes and pulse durations. We offer our customers solutions to implement performance-optimized, robust or cost-efficient beam sources for a wide range of applications.

Tailored Beam Sources

At Fraunhofer ILT, we develop lasers with wavelengths specific to a particular application. We see ourselves as drivers of innovation in this field of research and continuously expand the limits of what is feasible. We offer our customers from industry and research needs-based solutions so that they can implement new ideas and optimize existing laser sources, e. g. in terms of their robustness, efficiency or cost. Our R&D services range from design and simulation, through experimental investigations of laboratory samples, all the way to the development of industry-oriented, CE-certified prototypes. We support you with our many years of experience in all tasks and questions on this topic.

1 Diode-pumped Alexandrite laser.
2 Optical parametric generator.
3 Frequency doubling in PPLN.
4 Parametric source for entangled photons.

Technology Portfolio

Using tunable lasers, parametric beam sources and nonlinear frequency converters, we have already developed solutions for a wide range of specific requirements:

- Tunable wavelengths between UV and FIR
- All time regimes of ultrashort pulses up to continuous operation
- An average power of a single milliwatt up to many hundreds of watts and a pulse power up to one hundred megawatts

As part of our current research projects, we are continuously expanding the parameter areas and fields of application for lasers and optics together with our customers and partners.

R&D Services

With our experienced team of competent scientists, we support you in analyzing your specific needs, identifying and evaluating alternative solutions or defining target-oriented requirements, even in advance of joint projects. We accompany you with qualified project and quality management up to the implementation of industry-oriented prototypes.

Simulation and Design

We use commercial and proprietary software tools to realistically model the emission properties of beam sources, including thermo-optic effects and group delay phenomena. The simulations form the basis for the design of new lasers and frequency converters as well as for the analysis and optimization of existing systems.

Equipment and Expertise

As a development partner of laser manufacturers for many years, we know the supply market for all of the relevant key components, from dielectric mirrors to nonlinear crystals and we actively contribute to the qualification and further development of such components. The infrastructure of Fraunhofer ILT offers extensive analysis methods, such as LIDT (Laser Induced Damage Threshold) and PCI (Photothermal Common-Path Interferometry) measurements.

In the implementation of laboratory samples and prototypes, we can rely on a well-equipped modular system with extensive mounting and joining technology for lasers and frequency converters. Together with scientists from the packaging group, we are constantly developing our repertoire to meet new requirements.

Applications in the Field of Measurement Technology

Laser-beam sources with adapted wavelengths are frequently used in the field of metrology. Especially in atmospheric research, our robust beam sources are very much sought after because the conditions of use – such as on ships, in zeppelins, aircraft or in Arctic regions – are particularly demanding. We are currently developing the beam source for a LIDAR system for the precise detection of the greenhouse gas methane in the atmosphere for the Franco-German climate mission “MERLIN”. The system, whose core is a satellite-based OPO (Optical Parametric Oscillator), must meet extreme requirements for compactness, stability and efficiency for space applications.

Applications in Laser Material Processing

Laser material processing with adapted wavelengths uses frequency-converted lasers of high average power. In addition to optimizing established laser concepts with wavelengths around 1 µm and below, i. e. especially in the green and ultraviolet part of the spectrum, we also open up new wavelength ranges, especially in the long-wave infrared. Here, many technically and economically interesting material classes exhibit very high absorption.

Innovative Applications for Quantum Technology

In the field of quantum technology, we are developing innovative applications for parametric beam sources and frequency converters in close cooperation with top German and international researchers. These range from non-invasive sensor technology to secure communication and cryptography all the way to components for quantum computers of the future.

Contact

Dr. Bernd Jungbluth
Telephone +49 241 8906-414
bernd.jungbluth@ilt.fraunhofer.de

Dipl.-Ing. Hans-Dieter Hoffmann
Telephone +49 241 8906-206
hansdieter.hoffmann@ilt.fraunhofer.de